SECTION 15992

TESTING PIPING SYSTEMS

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Edit to suit project requirements.
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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure testing and [holiday testing] of the following systems:

1. Fire protection piping
2. Plumbing piping (sewer, water, rainwater/stormwater)
3. Natural gas piping
4. Compressed air piping
5. Instrument air piping
6. Hydronic piping
7. Steam and condensate piping
8. Refrigerant piping
9. Vacuum piping
10. Double wall containment piping (gravity system)
11. Laboratory gas piping
12. Holiday Testing (buried coated steel piping)

1.2 CONTRACTOR REQUIREMENTS

A. Notify the Construction Inspector at least 24 hours (1 working day) in advance to witness piping test.

B. Do not fill piping system until source of potable water supply is approved by the Construction Inspector.

C. For discharge requirements of potable water used for pressure testing, refer to Section 01325.

D. Notify the Construction Inspector immediately in the event of any accidental discharge.

1.3 CONSTRUCTION INSPECTOR REQUIREMENTS

A. For discharge requirements of potable water used for pressure testing, refer to Section 01325.

PART 2 PRODUCTS

A. Furnish instruments, equipment, material and labor necessary to conduct tests.

B. Calibrate testing equipment at reasonable intervals with devices of an accuracy traceable to the National Bureau of Standards (NBS).

C. Use pressure chart recorders that are dead weight calibrated and certified within the 30 days prior to each pressure test.

PART 3 EXECUTION

3.1 FIELD QUALITY CONTROL

A. Piping being tested shall remain exposed until the piping test has been approved by the Construction Inspector.

B. Trenches may be backfilled between joints before testing to prevent movement of pipe. Ensure that thrust blocks are sufficiently hardened before testing.

C. Piping being tested shall not leak nor show any loss in test pressure for duration specified, unless otherwise noted.

D. Where portion of piping system is to be concealed before completion, the portion shall be tested separately as specified for the entire system.

E. Ensure that piping system is free of trapped air.

F. At test pressure, visually check piping system to check for leaks and ensure that shut-off valves are fully open, allowing all parts of system to be tested.

G. Isolate system pressure relief valves, gages, sensors, etc., from pressure tests so instruments or devices are not damaged.

H. Drain the system if there is a potential for freezing; i.e., no heat in building, coil in outside air stream, or other similar situations.

3.2 PRESSURE TESTING

A. Fire Protection Piping:

1. Below Grade: Test with water at 200 psig for 2 hours with no visible leakage or drop in pressure.

2. Above Grade: Test with water at 200 psig for 2 hours with no visible leakage or drop in pressure per NFPA 13.

B. Plumbing Piping:

1. Sanitary Waste and Vent Piping Within Building To 5 Feet Outside Building:

a. Test with water in accordance with the Uniform Plumbing Code (UPC) to a minimum of 10 foot head of water. Keep water in system for at least 1 hour before inspection starts.

b. Acceptable alternate: Test with air at 5 psig and hold pressure for at least 1 hour.

2. Sanitary Sewer Piping Beyond 5 Feet Of Building To Site Main: Completely fill system with water and let stand for at least 1 hour before inspection starts, then visually inspect to ensure that all joints are tight.

3. Sanitary Sewer Force Main Piping Beyond 5 Feet Of Building To Site Main: Test with water at __*__ psig for 4 hours.

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*Test to 1 1/2 times operating pressure, 25 psig minimum.
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4. Potable Water Inside Building To Site Main: Test with water at __*__ psig for 4 hours.

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*Test to 1 1/2 times operating pressure, 100 psig minimum.
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5. Non-Potable Water: Test with water at __*__ psig for 4 hours.

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*Test to 1 1/2 times operating pressure, 100 psig minimum.
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6. Rainwater/Stormwater Piping:

a. Rainwater Piping Inside Building to 5 Feet Outside Building: Test with water in accordance with the Uniform Plumbing Code (UPC) to a minimum of 10 foot head of water. Keep water in system for at least 1 hour before inspection starts. Acceptable alternate: Test with air at 5 psig and hold pressure for at least 1 hour.

b. Stormwater Piping Beyond 5 Feet of Building: Completely fill system with water and let stand for at least 1 hour before inspection starts, then visually inspect to ensure that all joints are tight.

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Refer to Civil Specifications for testing of site water and sewer mains.
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C. Natural Gas Piping:

1. Operating pressure less than 1/2 psig (14 inches w.c.): Pressure test with air at 7 inches mercury, measured with a manometer or slope gauge, for 8 hours.

2. Operating pressure greater than 1/2 psig (14 inches w.c.) to 5 psig: Pressure test with air or inert gas at 50 psig for 8 hours. Record test with a continuous (24 hour) calibrated, dead weighted, pressure recording chart. Recorded pressure line shall be continuous, even and virtually "straight" without abrupt glitches, jogs, or changes. Pressure line shall return to its starting position pressure at end of 8 hour period.

3. Operating pressure greater than 5 psig to 100 psig: Pressure test with air or inert gas at 165 psig for 24 hours. Record test with a continuous (24 hour) calibrated, dead weighted, pressure recording chart. Recorded pressure line shall be continuous, even and virtually "straight" without abrupt glitches, jogs, or changes. Pressure line shall return to its starting position pressure at end of 24 hour period.

D. Compressed Air: Test with air at __*__ psig for 4 hours.

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*Test to 1 1/2 times operating pressure, 100 psig minimum.
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E. Instrument Air: Test with air at __*__ psig for 4 hours.

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*Test to 1 1/2 times operating pressure, 50 psig minimum.
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F. Hydronic Piping (heating hot water, chilled water, tower water, condenser water, make-up water and equipment drains): Test with water at __*__ psig for 4 hours.

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*Test to 1 1/2 times operating pressure, 100 psig minimum.
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G. Steam and Condensate Piping: Test with water at __*__psig for 4 hours.

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*Test to 1 1/2 times operating pressure, 100 psig minimum.
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H. Refrigerant Piping:

1. Test in accordance with the Uniform Mechanical Code.

2. Test pressure shall not be less than the lowest setting of any pressure-relief device installed in the side of the system it is protecting.

3. Maximum test pressure shall not exceed 2 1/2 times the operating pressure stamped on refrigerant container.

4. Pressure test with dry nitrogen for 24 hours. Record test with a pressure recording chart.

   a. CAUTION: Neither oxygen nor acetylene should ever be substituted for leak testing. Both of these gasses can cause a violent explosion if used for this purpose.

5. Pressure test systems operating at a pressure above atmospheric pressure as follows:

Refrigerant	Test-Pressure (psig)
R-11	150
R-12	235
R-22	300
R-123	150
R-134a	300
R-500	225
R-502	300
R-503	300

6. Pressure test systems operating at a pressure below atmospheric pressure (11.3 psig) to 20 inches of mercury, measured with a manometer or slope gauge for 24 hours.

7. After leak test has been completed and assumed to be free of leaks, charge

enough refrigerant to raise system pressure to approximately 10 psig. Then charge enough nitrogen into system to raise test pressure as noted above in Subparagraph 3.2.H.5.

8. Check all parts of system with a halide torch or electronic leak detector.

9. After successful completion of above test, evacuate and dehydrate system using vacuum pump. Connect an accurate high vacuum gauge to system.

10. Draw vacuum on system to 500 microns and allow to stand under a vacuum a minimum of 12 hours with maximum rise of 250 microns.

11. After successful vacuum test, charge system with system refrigerant. If start-up is not within 24 hours, temporarily pressurize system to 5 psig with system refrigerant.

I. Vacuum Piping: Test with clean air to 20 inches of mercury measured with a manometer or slope gauge for 4 hours.

J. Double Wall Containment Piping - Gravity System (radioactive liquid waste, industrial liquid waste and hazardous liquid waste - including vents):

1. Inner pipe and vent: Test with air at 5 psig for 4 hours.

2. Outer pipe: Test with air at 5 psig for 4 hours.

K. Laboratory Gas Piping:

1. Test (_____) piping with cylinder nitrogen at __*__ psig for 24 hours.

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*Test to 1 1/2 times operating pressure, 100 psig minimum.
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2. After the test has been satisfactorily completed, temporarily reduce pressure to 5 psig with system nitrogen.

3.3 Testing for Holidays

A. Test the following buried coated steel piping systems for holidays.

1. Natural Gas

2. [List other piping systems]

B. Perform holiday test in accordance with the following procedure:

1. After the pipe has been welded, joints wrapped, and the pipe is ready for lowering into the trench, test the coating for flaws (holidays). Test coated piping system throughout its length for flaws in the coating system by means of a high-potential flaw detector that can impress a maximum of 8,000 volts across the coating. One electrode of the tester shall maintain complete circumferential contact with the coating while transversing the entire length of the coating system, and the other electrode shall be the underlying metal pipe. An electrical discharge through the coating, detected visually, or by instrument, shall constitute failure of this test.

The actual working voltage of the detector on the pipe will depend upon the thickness of the coating and the size of the pipe. A thin coating on a large pipe will offer a capacitive load to the detector that will drop the working voltage

several thousand volts below the "no-load" voltage. The detector output may also have to be increased to overcome conditions such as extremely dry rock, or sandy soil.

Important! Do not cut the ground cable to a shorter length. The length supplied is important to proper operation of the detector. Keep as much of the cable as possible in contact with the earth. Straighten out kinks where possible and do not let it ride up over skids. In dry areas it will help to drag the cable in the ditch where there is more moisture. *The pipe should be grounded*.

2. Mark holidays as they are found and repair prior to lowering the pipe into the trench. Repair holidays in mill coating by removing the initial coating and undercoating for a minimum of 4 inches on each side of the holiday. Remove the coating around the holiday and feather the edges to the pipe wall for sufficient distance to make a satisfactory repair. Apply primer (polyken 1029)to the holiday to form a bond over the entire surface of the holiday and then spirally wrap the pipe with a double layer half-lapped 35 mill polyethylene tape (polyken 930) for a minimum of 2 inches on each side of the holiday.

   Repair holidays in joint wrappings by removing the field applied coating in the area of the holiday and rewrapping. The Construction Inspector or the designated representative will approve all areas of joint coating.

3.4 RETESTING

A. If the piping does not pass test, locate and repair leaks and repeat testing procedure until satisfactory results are obtained.

B. Make repairs to piping with new materials. No caulking on screwed joints, cracks, or holes will be acceptable.

END OF SECTION